WAPA IRP

Cooperative Filing

for

Pierre, SD

September 1, 2009

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I. MRES Resource Planning

A. Overview

Missouri River Energy Services (MRES) is a member-based joint-action agency, headquartered in Sioux Falls, South Dakota, with 60 member municipalities in the states of Iowa, Minnesota, North Dakota, and South Dakota. Of its 60 members, 57 are S-1 customers, each of whom receives hydroelectric preference power from the Western Area Power Administration (WAPA). These members purchase power from MRES to meet their needs over and above their WAPA allocations. In February of 2006, all 57 of the MRES S-1 members took action to extend the S-1 agreements from 2030 to 2046.

All of the MRES S-1 members receive hydroelectric preference allocations from WAPA and have purchase power agreements with WAPA to deliver power and energy from those allocations. The member cities purchase all supplemental power from MRES. Because of this contractual arrangement, all the supply-side resource planning is conducted by MRES on behalf of its members.

Conversely, the member cities own and operate their own distribution systems and perform all interfacing with the retail customer. Thus the member cities have the lead responsibility for demand-side and customer efficiency programs.

This document describes the overall process of coordinating the supply-side and demand-side planning into a cohesive, least-cost integrated resource plan.

B. Resource Plan Goals

The resource planning goals of MRES are to:

<u>Study Goal 1: Maintain the Adequacy and Reliability of Power Supply.</u> To meet this goal, load projections were developed for the MRES system, including the required additional 15% for planning reserves. All existing resources were assumed to remain in operation through at least 2020. However, it was assumed that due to the age of some of the units, about 10 MW of municipal capacity contracts would not be renewed after 2009.

According to these criteria, using only existing resources, MRES will experience a capacity deficit by the summer of 2013. Resource needs also increase notably in 2016 when MRES assumes all supplemental power requirements for the load of the City of Marshall, Minnesota, as a result of the expiration of Marshall's partial power supply contract with Heartland Consumers Power District (HCPD).

The focus of this study goal was to determine the lowest-cost, reliable plan which optimizes the amount of base load and peaking resources, specifically evaluating the Big Stone II Project (BSP II), combustion turbine (CT) units, wind turbines, new

Demand Side Management (DSM), and an Integrated Gasification Combined Cycle (IGCC) unit for the MRES resource mix.

Study Goal 2: Keep Members' Wholesale Rates Competitive. The primary objective of the study was to minimize the overall long-term power supply costs to MRES member communities. As a non-profit agency, all members share in the power supply costs of MRES. Minimizing the power supply cost for MRES will result in the minimal cost to the members.

Capacity expansion modeling was utilized to determine the least-cost MRES resource mix under a number of different scenarios. The analysis examined these resource combinations (both supply-side and demand-side) over the 2006 through 2025 timeframe. Surplus sales revenues were not considered in determining the optimal resource mix.

Study Goal 3: Minimize Adverse Socioeconomic and Environmental Effects. The referenced cases all applied Minnesota Public Utilities Commission-approved environmental externality prices and considered expected costs for mercury and SO_2 allowances when computing the least-cost plan. Those externalities were calculated using all MRES firm load, not just the Minnesota portion of the MRES loads. Several of the cases and scenarios specifically considered renewable resources, using wind for renewable energy for the purpose of meeting this study goal.

Another specific criterion of this goal was evaluation of the cost of voluntarily meeting the Minnesota Renewable Energy Standard (RES) to make a good faith effort to supply 25% of the energy served by MRES in the state of Minnesota with renewable energy by the year 2025.

Furthermore, when evaluating the environmental impact of MRES future resource mix, it was assumed that BSP II participants will spend an extra $55 million to not only clean the emissions from the new plant but also reduce emissions at the existing plant. Commercially proven technology (supercritical coal-fired boiler and advanced wet scrubber technology) will minimize coal consumption and achieve greater efficiency with fewer emissions. BSP II will meet or out perform all federal and state air emission regulations. While more than doubling the generation capacity, the Big Stone site will see emissions of sulfur dioxide, nitrogen oxides, and mercury from the two plants be less than or equal to the historical emissions from the existing Big Stone Plant.

In all of the MRES Resource Planning, all of the proposed DSM programs were assumed to promote environmental benefits through decreased energy consumption, which by definition decreases the amount of energy generated. Given that a majority of generation is from non-renewable sources, DSM programs will serve to decrease all emissions. Additionally, DSM programs that reduce electric demand will mean fewer new generation facilities will need to be constructed in the future.

Study Goal 4: Enhance the Ability of MRES to Respond to Changes and to Limit Risks. In meeting this goal, the Resource Plan discusses and analyzes several of the potential risks MRES could face once it selects the Base Case plan. These risks, along with several other significant risks related to resource planning, were addressed in the Resource Plan. The Resource Plan also discusses the risks of having a single unit supplying much of the MRES energy supply.

Study Goal 5: Meet Resource Plan Filing Requirements. MRES endeavored to meet the requirements of Minnesota statutes and WAPA standards for integrated resource plans. In the analysis of the scenarios for the capacity expansion modeling, MRES balanced the needs of the members with that of the environment. MRES is committed to maintaining the reliability of power supply, while providing predictability and reasonableness of rates for residential, commercial, and industrial customers. At the same time, MRES is also committed to expansion of its renewable resources and taking a more active role in DSM. In the analysis of various scenarios, environmental concerns such as emissions were evaluated and also balanced with such considerations as the need for firm base load power and stabilization of energy costs. In the end, the analysis of the various scenarios in the context of these goals resulted in a choice of resource mix that is environmentally responsible, cost-effective, and balanced.

C. Load Forecasting

The MRES load forecasts are based upon a short-term forecast blended into a long-term econometric forecast. Each forecast predicts the aggregate total usage for each member city for each month of the forecast horizon. By subtracting the allocated amounts of WAPA demand and energy, the monthly MRES demand and energy sales to each member is obtained.

The following steps were followed to develop a load forecast for each member municipality.

i. Develop Long-Term Forecast

This includes updating the historical files for monthly energy usage and all of the independent variables, forecasting values for independent (explanatory) variables, generating long-term energy models for each member, including any spot load adjustments; and selecting a final long-term energy model for each member.

Annual data for variables believed to be useful in predicting total energy were input into a software package called MetrixND® and regression models were constructed for each city. The city total energy was the dependent variable for each model. Possible independent variables included county census data for the county in which the city is located, weather data from the nearest weather station, national economic statistics, and alternate fuel prices for the region. A number of possible models were tested for each city, and certain criteria were scrutinized in order to find a model that was statistically sound and provided a reasonable expected growth rate. Models were selected primarily based on adjusted R-square, Mean Absolute Percentage Error (MAPE), T-statistics, and Durbin-Watson statistics. The long-term forecast was based on a regression analysis of annual historical data from 1970 through 2007 (when available) and created annual energy forecasts through 2040.

ii. Develop Short-Term Forecast

Independent of the long-term modeling process, the short-term forecasts were generated using a multiple regression analysis. For the last five years of the analysis, monthly city total energy was the dependent variable for each model. The primary independent variables included monthly cooling, heating, and total degree days for the weather station representing the city.

Both the one-month and twelve-month lagged energy variables were included in some models, if necessary, to achieve acceptable statistical results. The logarithmic transformations of one-month and twelve-month lags were made available as independent variables.

A linear trend variable and the logarithmic transformation of the linear trend were included in some models, if necessary, to achieve acceptable statistical results. Any long-term growth (or negative growth) realized by the cities should be accounted for by including a trend component. A maximum of one trend or transformation of a trend variable was allowed per model.

Monthly binary variables were used to account for the monthly variation in energy sales. Binary variables take the value of one or zero depending upon a condition occurring or not occurring. There were 11 binary variables, with the first binary variable, d1, being equal to 1 for January, and the other ten binary variables being equal to 0 in January. The second binary variable, d2 is equal to 1 for February, and the other ten binary variables being equal to 0 for February, and so on. It is mandatory in regression modeling that one month does not have a binary variable, in order that some base level is set, and subsequent months are either an addition or a subtraction to that base level. Subsequently, the constant is the 12th binary variable. In this case, December was the month not represented by a binary variable. All 11 monthly binary variables were forced into each regression model.

iii. Blend Short-Term and Long-Term Forecasts

The short-term forecasts were used for each member through the remainder of the current year and one additional year. After that year, each member's annual growth rates from the long-term forecasts were used to extend the forecasted energy into a long-term "blended" base forecast that extends to the year 2025 and beyond.

iv. *Effects of Weather Extremes on Peak Demand*

The forecasting process as described so far is based on normal weather. However, MRES must provide enough capacity to meet its peak plus reserve requirements under fairly extreme weather conditions, or be faced with financial penalties for insufficient generation reserves. Therefore an “Extreme Weather” demand forecast was computed by substituting higher degree day values into the load forecast models. The higher degree day values were from the 90^{th}-percentile monthly degree days, instead of the average monthly degree days that are used in the Base Case.

v. *Calculate MRES vs. WAPA Loads*

Once the forecasted values were obtained, the forecasts for each member were processed by a calculation that splits the energy and demand between WAPA and MRES. The amount of energy and demand that a member receives from WAPA is called the Contract Rate of Delivery (CROD), and is based on a formula specified in the WAPA firm power contracts of each member.

WAPA offers more than one method of defining its allocation of power to their customers. Most of the MRES member cities have selected the "Fixed CROD" method. One S-1 member is using the older "Seasonal X/Y" method. All of the Minnesota members that purchase power from MRES are using the Fixed CROD method.

Under the Fixed CROD method, each city is assigned a monthly allocation of demand and a monthly allocation of energy from WAPA. Any amount of demand or energy exceeding that monthly allocation is provided by MRES. The allocations are the same from year to year for each city, although they vary each month within the year. Also, the allocations were reduced by approximately 4% in January 2001 to allow WAPA to create new allocations for certain new customers and Native American loads, and were reduced again by 0.25% in January 2006 to create new allocations for additional WAPA customers. Similarly, the contracts allow WAPA to reduce the amounts by another 1% in January 2011. Those reductions are assumed to occur for the calculations done for this filing.

Once the WAPA allocations are subtracted from the city loads, the remainder is the amount that MRES supplies to each city.

The load factors of the WAPA allocations do not change from year to year and are different from the load factors of the cities. Because MRES serves the portion of each city’s load not supplied by WAPA, the MRES sales also have a different load factor than each city's total load.

vi. Calculate MRES Generation Requirements

An important aspect of capacity planning is determining the amount of planning reserve capacity required by the Mid-Continent Area Power Pool (MAPP).

To allow supplemental suppliers such as MRES to calculate their MAPP requirements, WAPA has agreed to be responsible to MAPP for the highest fixed CROD value for each of its customers in any given season. For instance, if a customer's highest fixed CROD allocation is in June, WAPA is responsible for that amount of the load during the entire summer season for purposes of MAPP capacity requirements. Thus, even if that member city peaks in August, MRES is responsible for only the portion of that city's August loads above the city's June allocation.

Thus, the method that MRES uses to calculate its generating capacity requirement for MAPP each month is referred to as the "Peak Load Responsibility," assuming normal load growth plus extreme weather conditions. The calculation is based on the following information:

- The monthly demand readings plus wheeling losses, in kW, are obtained from the Extreme Weather version of the base load forecast.

- The seasonal maximum Fixed CROD allocations for the member cities on the Fixed CROD method are subtracted to obtain the MRES portion. If a city's load is less than their seasonal maximum fixed CROD, the MRES portion is set to zero. For the one member using the Seasonal X/Y allocations (Valley City, ND), the appropriate x/y amount is subtracted. This is the portion of the load for which WAPA, not MRES, is responsible for providing planning reserves.

- The values are increased for WAPA and Nebraska Public Power District (NPPD) transmission losses, and are reduced for the estimated peak diversity between member peaks. The coincident demand is always less than or equal to the sum of the individual peak demands of the cities, since the cities generally do not peak at exactly the same time.

- Finally, 15% of the highest monthly demand in the current and previous 11 months is added to the total to represent the MAPP planning reserve requirements. These forecasted values represent the capacity requirements of MRES in the cost forecast calculations.

D. *Current Generation Resources*

MRES, either directly or through its contracts with Western Minnesota, has a combined accredited generating capacity of about 544.2 MW (summer seasons) or 560.1 MW (winter seasons):

- Laramie River Station (LRS): 271.8 MW
- LRS Peaking Capacity: 8 MW
- Exira Station: 139.7 MW
- The Watertown Peaking Plant (WPP) location: 47.7 MW summer, 58.5 MW in winter
- Municipal Capacity: 106.1 MW
- Each S-1 member city receives a monthly allocation of WAPA demand and energy, totaling approximately 349 MW (summer seasons) and 307 MW (winter seasons).

In addition to the accredited capacity, MRES has limited unaccredited capacity, as identified in the Resource Plan. MRES continues to receive the output from wind projects located in Worthington, Moorhead, Marshall, and Odin, Minnesota, totaling over 43 MW. MRES is also able to reduce its load under the Interruptible Load agreement with retail commercial and industrial customers of members who own backup generators. This accounts for 3.7 MW.

E. *MRES Resource Planning Development*

This section includes a summary of the capacity expansion study process. Included is a description of the resource options considered in the resource planning combinations, a summary of the risks to be studied in the scenario analysis, and a summary of the generation and transmission resource planning results.

i. Modeling Method

MRES utilized Strategist® capacity expansion software in the development of the resource plan. This methodology allows base load and peaking resources to compete with renewable energy resources, conservation, and energy efficiency in developing the resource plan that minimizes costs. Once the optimal resource mix was identified and the Base Case was developed, several scenarios were analyzed to determine the financial risk associated with unexpected events.

ii. Needs for Additional Capacity and Energy

The load forecast indicates that no additional capacity is needed until the summer of 2013. Even with the addition of new DSM programs, MRES is expected to have a capacity deficit of 108 MW by 2016, 140 MW by 2020, and 179 MW by 2025.

iii. Resource Options Considered

Many different resource options were considered for the capacity expansion modeling, but only a subset of the options were chosen for detailed study after considering their relative costs and availability. When selecting potential resources for detailed study, consideration was given to several factors:

- Diversity – It is desirable for MRES resources to be located across a broad geographic area. This minimizes the chance for a single transmission outage to significantly impact the ability to serve MRES loads.

- Reliability – MRES prefers to add resources that are of a proven technology. This minimizes the severity of unexpected forced outages.

- Dispatchability – With the exception of future wind resources, it is assumed that all future generation should be dispatchable. This is essential for MRES to be able to meet its demand on peak days.

- Other risk factors – Other factors affecting the operation of any future resources were considered, such as the price and availability of fuel.

After this screening process, detailed purchase or build options were developed for these standard types of resources:

1. <u>Base load #1</u>: A pulverized coal unit to be available in 2013. The BSP II project was used for estimating the parameters of this unit.

2. <u>Base load #2</u>: An Integrated Gasification Combined Cycle (IGCC) to be available in 2013.

3. <u>Peaking</u>: Natural Gas-fired Simple-Cycle Combustion Turbine (CT) units.

4. <u>Intermediate</u>: Natural Gas-fired Combined Cycle (NGCC) units.

5. <u>Renewable #1</u>: 1000 kW Wind Turbines with a 40% assumed plant factor and 15% accreditation installed in 100 MW farm sizes.

6. <u>Renewable #2</u>: 1000 kW Wind Turbines with a 40% assumed plant factor and 0% accreditation installed in 10 MW farm sizes.

7. <u>DSM (Demand Side Management)</u>: New DSM program savings totaling 112.6 MW of load reduction by 2025.

iv. Future DSM Activities

In the latest Integrated Resource Plan (IRP), MRES conducted a capacity expansion analysis that analyzed the impact of various increased levels of DSM on supply-side choices, estimated the cost of DSM, and incorporated it into the capacity expansion modeling; letting DSM compete freely against supply-side resources.

1. Estimation of Existing and Potential New DSM

   MRES staff surveyed members, reviewed their most current energy efficiency and conservation reports, and conducted telephone interviews to assess current DSM activities within the entire S-1 membership. The information reviewed included WAPA Integrated Resource Plans and updates for North Dakota members, South Dakota members, and for Denison, Iowa. For the balance of the Iowa S-1 members, MRES relied on annual energy efficiency reports that members file with the state. For Minnesota members, MRES obtained their Conservation Improvement Program (CIP) reports. Additionally, MRES retained a consulting firm, Summit Blue, to review this information. Summit Blue used this information in their estimations of the potential DSM savings amounts and costs of feasible new DSM programs.

   Based on this information, and on benchmark data from Minnesota investor-owned utilities, Summit Blue estimated the current saturation amounts for 27 commercial/industrial and 13 residential DSM technologies likely to be feasible in the S-1 membership. Summit Blue also estimated the technical potential theoretically possible, and the achievable potential most likely to be reached under each program. MRES staff reviewed the Summit Blue results and discussed many of the assumptions and results to be sure they reflected the status of the MRES membership.

   According to the results of the final Summit Blue study, the potential DSM programs had an estimated achievable potential of up to 112.6 MW by 2025. These are load reduction impacts in addition to current DSM activities already assumed in the historic and forecasted loads. However, not all of the 40 potential DSM programs are necessarily cost effective when compared against future supply-side options. This will be further discussed in Section 6 “Resource Planning Results.”

2. Grouping of DSM Programs into DSM Portfolios

   MRES staff used the results of the Summit Blue analysis to group the 40 potential DSM programs into ten DSM Portfolios, each representing between two and seven individual DSM programs. This step reduced the volume to a manageable number to be evaluated in this analysis.

When grouping programs, similar programs were grouped together, and the most expensive programs were separated from the others to evaluate less costly programs separately from expensive ones. The ten DSM portfolios, and the DSM programs making up those portfolios, were defined as follows:

- Low Cost Cooling
- High Cost Cooling
- Low Cost Custom Commercial
- High Cost Custom Commercial
- Low Cost Water Heating
- High Cost Water Heating
- Lighting
- Refrigeration
- Building Envelope
- Direct Load Control

3. Integration of DSM Portfolios into the Capacity Expansion Analysis

   The Strategist planning model was used to calculate the least-cost combination of supply-side and DSM resources in each scenario. DSM portfolios were included in the Strategist model as optional resources beginning in 2009, freely available for selection by the model as economics dictated.

v. Renewable Energy Resources

MRES has existing renewable energy resources and is planning renewable resource additions as an integral part of the resource planning process. The expansion of renewable resources in the MRES portfolio is important to meeting its mission to provide environmentally responsible energy and to make a good faith effort in meeting Minnesota's Renewable Energy Standard (RES). MRES continues to receive the output from wind projects located in Worthington, Moorhead, Marshall, and Odin, Minnesota, totaling over 43 MW. In addition to this existing wind generation, MRES plans to construct an additional 90 MW of wind generation by 2025 to comply with the Minnesota RES objective. These future wind installations were forced into the model as a minimum, with the model being able to voluntarily add more than 90 MW if found to be economical.

vi. Emission Costing

MRES used the emission externality costs for PM_{10}, CO, NOx, and lead as approved by the Minnesota Public Utilities Commission (PUC) for each case for all new resources. Because all current and future fossil-fuel resources of MRES are located outside of Minnesota, the costs were based on the Minnesota environmental externality values as published by the Minnesota PUC for resources within 200 miles of the state, inflation adjusted. The published Minnesota CO_2 externality price was zero for such resources, so this was the value used in this resource study.

The cost of SO_2 emission allowances were included in each Strategist case based on estimated market price for allowances, as anticipated by the Minnesota PUC's externality values. The cost was applied to the tons of SO_2 emissions produced by any new resources included in each case. This is consistent with the active emissions trading activities of MRES staff. The MRES allowance portfolio value will be affected by the market cost of future allowances.

The potential cost of mercury control was also assessed. It was assumed that emission limits or allowance pricing would apply in the future for mercury emissions. This cost was applied to the pounds of mercury emissions produced by any new resources included in each case.

F. Resource Planning Results

After accounting for all of the details listed above, Strategist capacity expansion software modeling indicated that the least-cost expansion plan for MRES is 120 MW of Big Stone II capacity added in 2013. Additionally, all ten DSM Portfolios were considered to be optimal, amounting to 112.6 MW of load reduction by 2025. Multiple alternative scenarios were also evaluated to consider various effects, such as low or high load forecasts, or low or high natural gas prices. In some scenarios, only nine of the ten DSM portfolios successfully competed against the supply-side alternatives. The High Cost Cooling portfolio failed to be optimal in some scenarios. However, because the High Cost Cooling portfolio only failed by a narrow margin, and only in some scenarios, it was included in the optimal resource mix.

Listed below are the additional resources identified by MRES as part of the least-cost expansion plan:

Base Case Scenario			
Year	**Unit**	**MW**	**Unit Type**
2013	BSP II	120	Coal
2009-2025	DSM	112.6	DSM: 6.6 MW per year

G. Implementation

As a wholesale supplier, MRES has not had a direct relationship with its members' retail customers. Because energy efficiency programs are implemented at the retail level, DSM has traditionally been the responsibility of each individual member. In the past several years, MRES staff has assisted the members with some programs, such as digital infrared thermography, compressed air leak detection, and similar large customer energy efficiency programs. In an effort to bridge the traditional gap between MRES as a wholesale supplier, and its members as retail DSM providers, the MRES Board of Directors began efforts in early 2006 to integrate these conservation efforts. A few of these efforts are described below.

i. DSM Task Force

Once the DSM programs were found to be part of the optimal resource mix, the MRES Board of Directors created the DSM Task Force in 2006 to chart a course toward implementing programs to achieve the goal of 112.6 MW of savings by 2025. The Task Force is comprised of 14 representatives from member communities, including at least one member of the Board of Directors, who will work together with the new MRES Manager of Energy Services. The purpose of the Task Force is to evaluate conservation and demand strategies that will allow MRES to achieve the DSM goals identified, and to make recommendations to the Board of Directors regarding implementation of those strategies. The recommended work plan for the task force anticipates that it will evaluate and rank DSM programs, including those proposed by the Summit Blue report, determine their respective roles of MRES and its individual members, and develop marketing and implementation strategies for recommendation to the MRES Board of Directors. MRES staff will be responsible for meeting with each member community individually to inform them of the benefits of the proposed program, and review with them the roles and responsibilities of members of MRES in energy conservation.

ii. Bright Energy Solutions

One of the recommendations of the DSM Task Force was for MRES to create a brand that encompasses all of the DSM program offerings to the member communities. MRES created Bright Energy Solutions to assist the members in implementing DSM activities, to provide consistency in programs throughout the membership, and to make programs easily identifiable to customers and regional trade allies.

MRES conducted further study work to design individual measures and programs to be offered through Bright Energy Solutions. Bright Energy Solutions is currently offered to commercial and industrial customers of participating MRES member utilities. The Bright Energy Solutions program offers a portfolio of energy efficiency cash incentive programs that will help the member's customers reduce their electric energy costs and operate more efficiently. MRES anticipates expanding Bright Energy Solutions offerings to residential customers in 2009.

H. List of Potential Programs

Under the Bright Energy Solutions program, MRES began to offer incentives in January 2008, through our member utilities, to commercial and industrial customers for the following equipment:

- Energy efficient lighting
- Energy efficient air conditioning, chillers, and other cooling technologies
- Energy efficient motors, pumps, and variable frequency drives
- Custom program for energy efficient improvements to process equipment or other customer-specific equipment

These commercial and industrial programs were chosen by the DSM Task Force as measures that could achieve the highest demand savings in the shortest amount of time, taking into consideration that 70% of our members' retail sales are made to commercial and industrial customers. These programs became the DSM Phase I programs for MRES.

Throughout 2008, MRES worked with our Minnesota members to develop additional energy efficiency programs that would help the members increase kWh savings in order to meet a 1.5% energy savings goal by 2010. This new savings goal was part of the Next Generation Energy Initiative that was adopted by the Minnesota Legislature in 2007. After those programs were developed for the MRES Minnesota members, the MRES Board of Directors examined whether the new menu of programs should be offered to the entire MRES membership. In August 2008, the MRES Board voted to offer the new menu of programs in all four states served by MRES as MRES DSM Phase II programs.

The Phase II offerings that MRES plans to launch throughout 2009 and 2010 include additional efficiency programs for commercial and industrial (C & I) customers, as well as several programs for residential customers. These programs are listed below with their anticipated start dates:

- Prescriptive, which includes energy efficient refrigeration, restaurant, and miscellaneous equipment (January 2009)
- Custom, which includes:
    - Bonus Program for kWh savings (January 2009)
    - C & I Intensive Energy Audits (August 2009)
    - C & I New Construction Program (October 2009)
    - Request for Proposal (RFP) (January 2010)
- Residential HVAC Program (October 2009)
- Energy Star® New Construction (October 2009)
- Appliance Turn-in Program (March 2009)
- Residential Energy Star Products (January 2009)
- Residential Lighting (February 2009)

- Direct Load Control (June 2010, pending approval from MRES Board of Directors)

As part of the development of both the Phase I and Phase II Bright Energy Solutions programs, a number of steps were taken to analyze the costs, benefits, and applicability of the programs, both from the MRES perspective and the member utility perspective. That evaluation is described below.

i. Economic Analysis of Energy Efficiency

As MRES started developing DSM programs and making decisions about which efficiency measures to rebate and where to set rebate levels, it became apparent that more in-depth economic analysis was needed. MRES worked with consultant Morgan Marketing Partners to guide in the development of the DSM programs and rebates. The incentive levels set for the measures covered by the program were assessed through a cost-effectiveness analysis using DSMore software, a model that evaluates the Total Resource Cost (TRC), Utility Cost Test (UCT), Ratepayer Impact Measure (RIM), Societal, and Participant test. The cost-effectiveness tests account for the energy and demand savings, associated avoided costs, net benefits to MRES members, incremental or installed costs, and the program costs.

The test that is the most applicable, and most important, to MRES in determining cost-effectiveness is the UCT. This test compares the costs of DSM to the benefits of the program from the utility perspective. The costs of DSM include the incentives that are paid to the customer, the administrative costs, and the marketing or promotional costs. For MRES, the benefit of DSM is a reduction in future costs to MRES. By achieving savings through DSM, MRES has the opportunity to avoid purchases on the open market virtually every day. MRES chose to offer the energy efficiency measures that were found to be cost-effective using the UCT test. The results of all other tests were reviewed and considered as well. If a measure passed the UCT test, but did not pass one or more of the other Standard Practice Manual tests, those measures were given particular scrutiny to determine whether the measure should be offered by MRES. Factors that were considered included the cost to the participant, the benefits to the participant, the value of environmental benefits, and possible rate impacts to non-participants.

ii. Member Program Selection

MRES offers the menu of Bright Energy Solutions programs to all S-1 members. Members may choose to offer any or all of the programs based on the demographics and needs of their customer base and their own preferences. MRES provides all of the incentives offered through the programs as a reimbursement to the member utility. MRES also provides marketing materials that each member can customize for their own use, as well as technical assistance and field inspection assistance when the incentive is in excess of $10,000 per retail customer for a given program. MRES tracks the incentive amounts and kW and kWh savings from all rebate applications and provides summary information to its members on a quarterly basis for their community. MRES members must answer customer questions, review applications, conduct field inspections for rebates under $10,000, and issue checks for rebates.

iii. Calculation of Savings

The savings calculations for all prescriptive rebates under Bright Energy Solutions are based on the algorithms provided by the Minnesota Department of Commerce in its Deemed Savings Database. For custom rebates, the kW and kWh savings will be determined using engineering calculations. Customers and contractors will submit their projects to MRES for review, including estimated kW and kWh savings. MRES staff, or its subcontractor, will review these projects and savings estimates and determine the level of incentive to be awarded. This review of the savings analysis helps assure that MRES funds are being cost effectively used to promote efficiency.

iv. Environmental Benefits

In addition to helping customers reduce and manage their energy costs, the Bright Energy Solutions programs provide other societal benefits. These include reduced greenhouse gas emissions, as well as reductions in SOx, NOx, and mercury emissions. The estimated value of the environmental benefits was considered as part of the Societal Test when determining cost-effectiveness of the programs.

II. Pierre, SD Resource Planning

A. City Information

Pierre, located in Hughes County, is the capital of South Dakota and is a community of more than 13,800 individuals located in central South Dakota. The City has four elementary schools, one junior high, one high school, two parochial schools, and the Pierre Indian Learning Center. The residential sector includes 5,949 housing units, and the median age of the population is 38 years. About 14.1% of the population is 65 years of age or older and about 27.2% percent are under 18 years old.

In 2006, the municipal utility had 5,951 residential customers, 993 commercial customers, and 157 industrial customers. The residential sector's yearly usage averaged 11,757 kWh per customer in 2006. Commercial customers averaged 28,893 kWh, and industrial customers averaged 554,280 kWh.

The rates for each type of customer are shown on the rate sheet in Exhibit 1. As of January 2008, the residential sector was charged 5.9 cents per kWh, and received a fixed customer charge of $8.50. Small commercial customers were charged 6.3 cents per kWh, and received a fixed customer charge of $16.00. Large commercial customers were charged 3.0 cents per kWh and received a fixed service charge of $27. Additionally, large commercial customers also paid a demand charge of $8.80 per kW.

Exhibits 7 and 8 each show the peak day (along with the day before and the day after) for those two seasons. The winter peak graph shows the load remaining flat from midnight to roughly 5 am then increasing till 8 am. The load then begins to decline until 5 pm followed by an increase until 10 pm. The summer peak graph indicates the load increasing from 6 am until peaking at 5 pm. Then a steady decline occurs until 6 am the next day.

Exhibit 1

PIERRE, SOUTH DAKOTA
2008 RETAIL ELECTRIC RATE SCHEDULE

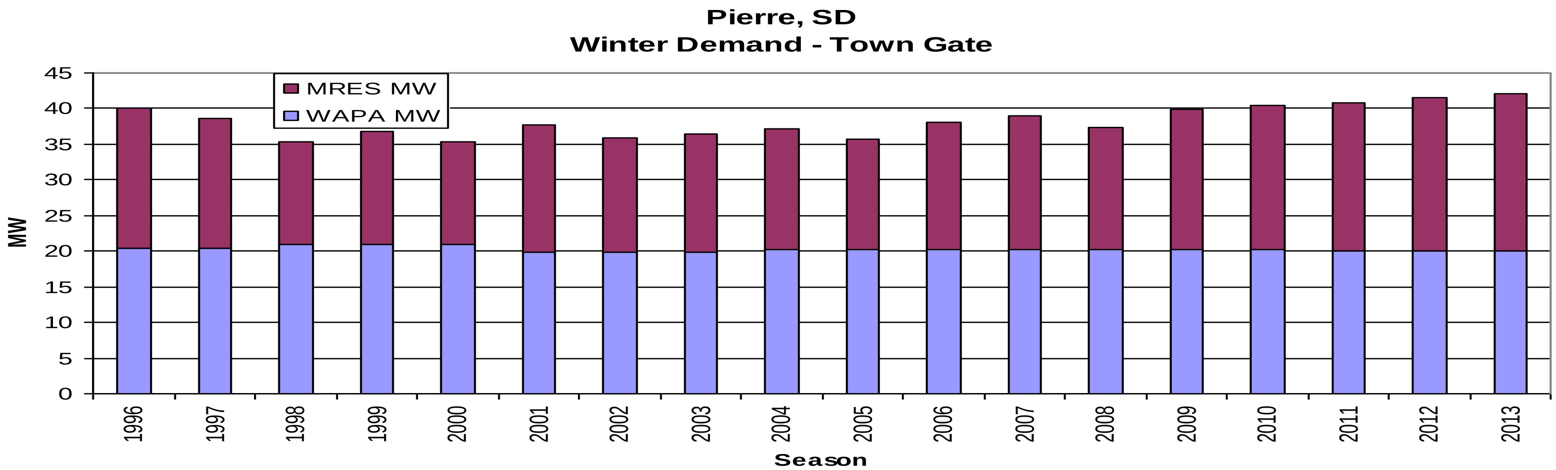
Customer Class	Rate Component	Current Rate
Residential	Customer Charge	$8.50
	$/kWh	$.059
Small Commercial	Customer Charge	$16.00
	$/kWh	$.063
Large Commercial	Customer Charge	$27.00
	$/kWh	$.03
	$/kW	$8.80

Exhibit 2

MRES Seasonal Load Report | Pierre, SD | 10/22/08 9:44 AM
Pierre, SD | Town Gate
Town Gate Load | Monthly Splits
01BASE Forecast | Historic Through 9/2008

	Demand (kW)					Energy (kWh)			
Summer	Total	WAPA	MRES	Other	Summer	Total	WAPA	MRES	Other
1996	37,182	27,597	9,999	0	1996	81,161,881	63,159,000	18,002,881	0
1997	36,228	28,075	11,802	0	1997	81,691,934	65,215,000	16,476,934	0
1998	39,634	28,075	15,208	0	1998	85,680,893	65,215,000	20,465,893	0
1999	40,448	28,068	16,022	0	1999	85,087,453	65,215,000	19,872,453	0
2000	40,098	28,075	14,405	0	2000	88,508,506	65,215,000	23,293,506	0
2001	42,055	26,952	17,139	0	2001	90,599,084	62,607,000	27,992,084	0
2002	42,343	27,626	18,894	0	2002	94,197,912	62,607,000	31,590,912	0
2003	41,032	26,952	17,583	0	2003	91,900,445	62,607,000	29,293,445	0
2004	40,774	26,952	17,325	0	2004	87,644,023	62,607,000	25,037,023	0
2005	39,592	26,952	14,695	0	2005	92,674,224	62,607,000	30,067,224	0
2006	44,483	27,581	21,072	0	2006	100,470,836	62,504,000	37,966,836	0
2007	45,525	26,908	22,114	0	2007	99,044,825	62,504,000	36,540,825	0
2008	39,320	27,581	15,909	0	2008	93,081,325	62,504,000	30,577,325	0
2009	42,772	27,497	19,361	0	2009	98,125,568	62,504,000	35,621,568	0
2010	43,285	27,581	19,874	0	2010	99,303,299	62,504,000	36,799,299	0
2011	43,808	27,305	20,632	0	2011	100,502,062	61,876,000	38,626,062	0
2012	44,340	27,305	21,164	0	2012	101,721,857	61,876,000	39,845,857	0
2013	44,880	27,305	21,704	0	2013	102,962,679	61,876,000	41,086,679	0
	Demand (kW)					Energy (kWh)			
Winter	Total	WAPA	MRES	Other	Winter	Total	WAPA	MRES	Other
1997	38,315	20,410	18,215	0	1997	93,979,181	52,587,000	41,392,181	0
1998	35,269	21,042	14,227	0	1998	85,736,232	53,969,000	31,767,232	0
1999	36,210	21,042	15,800	0	1999	85,065,511	53,969,000	31,096,511	0
2000	32,727	21,042	14,264	0	2000	84,688,676	54,324,000	30,364,676	0
2001	35,894	19,806	17,848	0	2001	94,640,789	51,457,000	43,183,789	0
2002	34,303	19,806	16,022	0	2002	88,889,855	50,798,000	38,091,855	0
2003	36,457	19,806	16,651	0	2003	90,983,891	50,798,000	40,185,891	0
2004	37,087	20,280	16,807	0	2004	91,238,344	52,354,000	38,884,344	0
2005	35,645	20,280	15,365	0	2005	90,855,179	52,012,000	38,843,179	0
2006	35,521	20,236	17,782	0	2006	92,948,867	51,934,000	41,014,867	0
2007	38,407	20,236	18,664	0	2007	96,029,369	51,899,000	44,130,369	0
2008	37,297	20,236	17,061	0	2008	97,026,976	52,240,000	44,786,976	0
2009	37,675	20,236	19,656	0	2009	100,189,185	51,899,000	48,290,185	0
2010	38,127	20,236	18,272	0	2010	100,547,231	51,899,000	48,648,231	0
2011	38,588	20,033	18,770	0	2011	101,758,645	51,540,000	50,218,645	0
2012	39,056	20,033	19,322	0	2012	102,991,440	51,715,000	51,276,440	0
2013	39,533	20,033	19,769	0	2013	104,245,615	51,377,000	52,868,615	0

Exhibit 3


Pierre, SD
Winter Demand - Town Gate
MRES MW
WAPA MW
MW
0
5
10
15
20
25
30
35
40
45
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Season

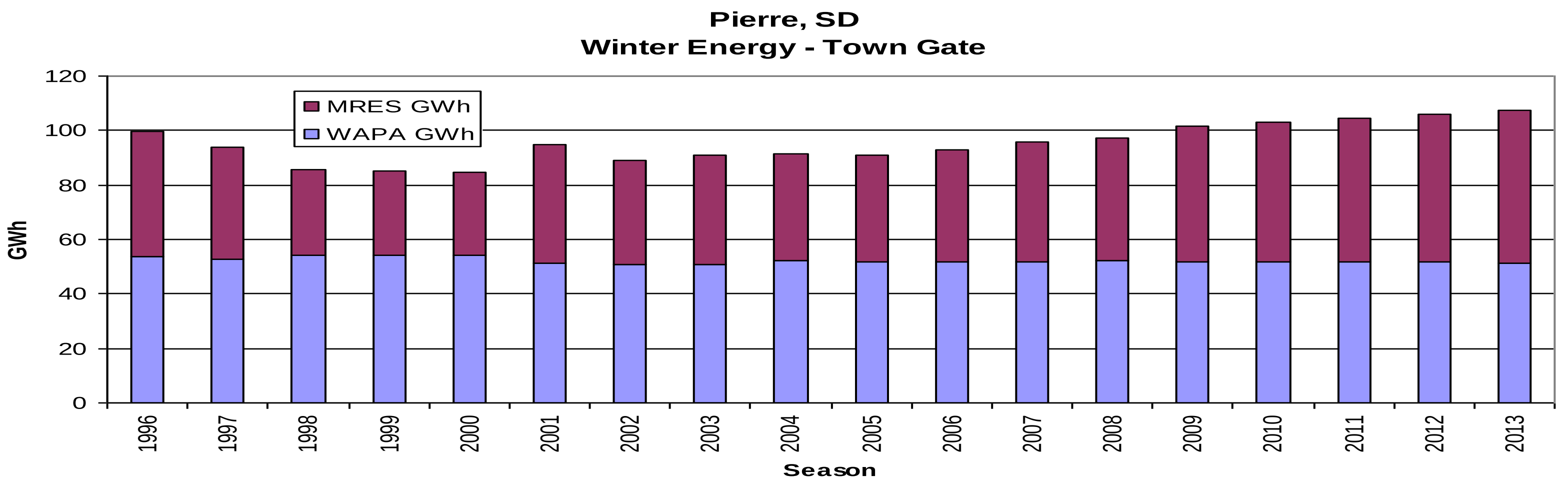
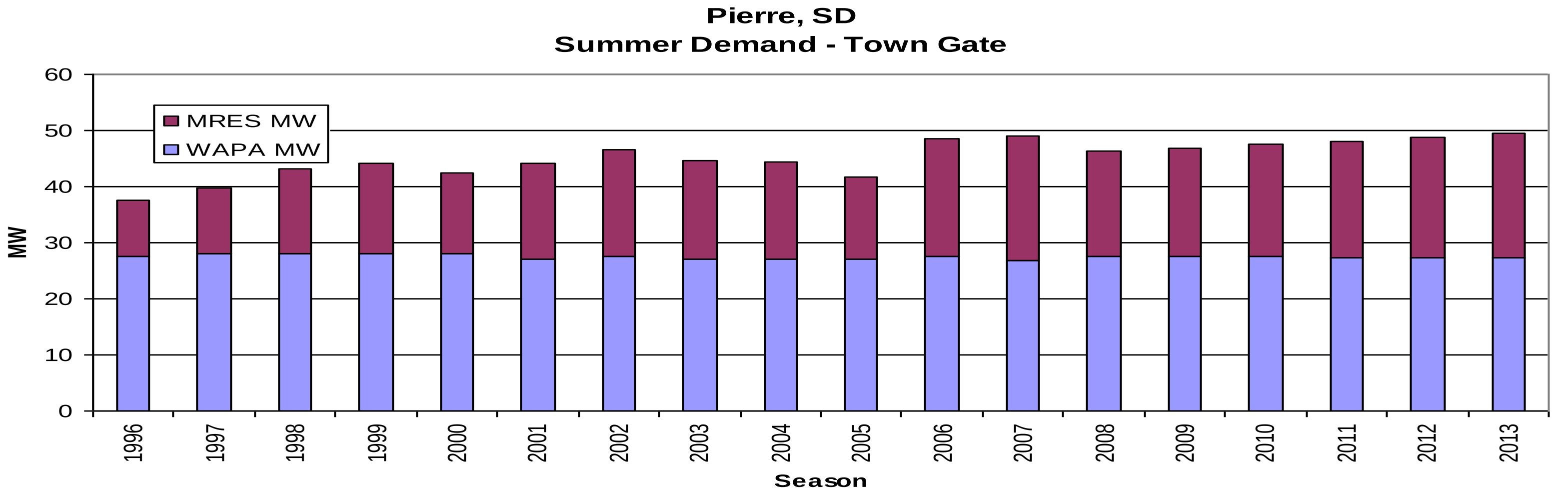

Pierre, SD
Winter Energy - Town Gate
MRES GWh
WAPA GWh
GWh
0
20
40
60
80
100
120
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Season

Exhibit 4


Pierre, SD
Summer Demand - Town Gate
MRES MW
WAPA MW
MW
60
50
40
30
20
10
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Season

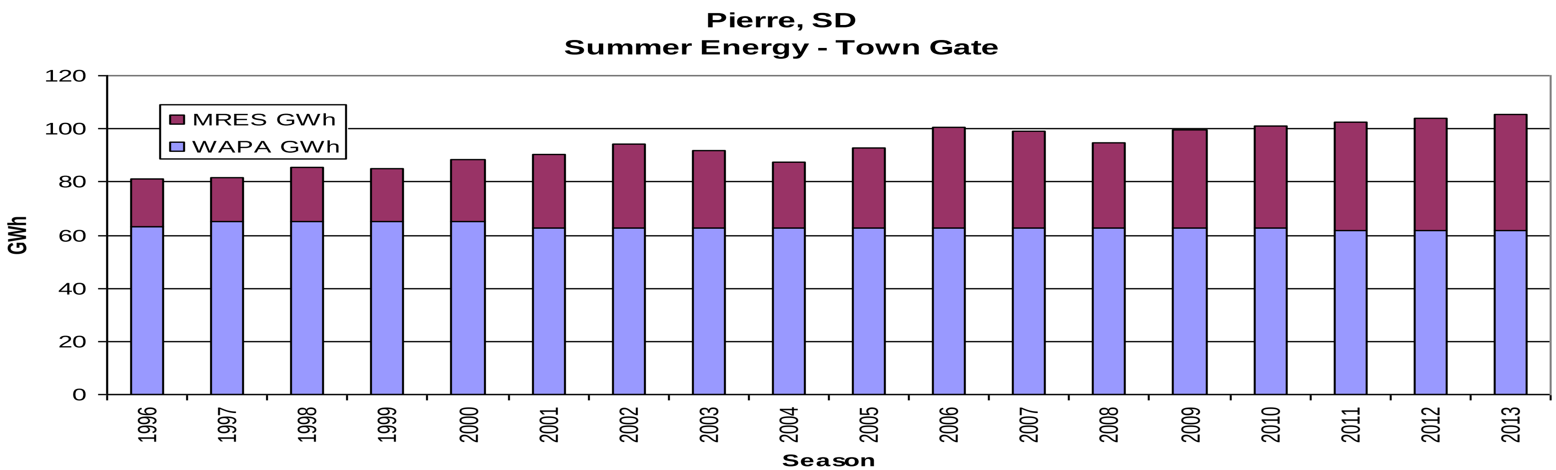
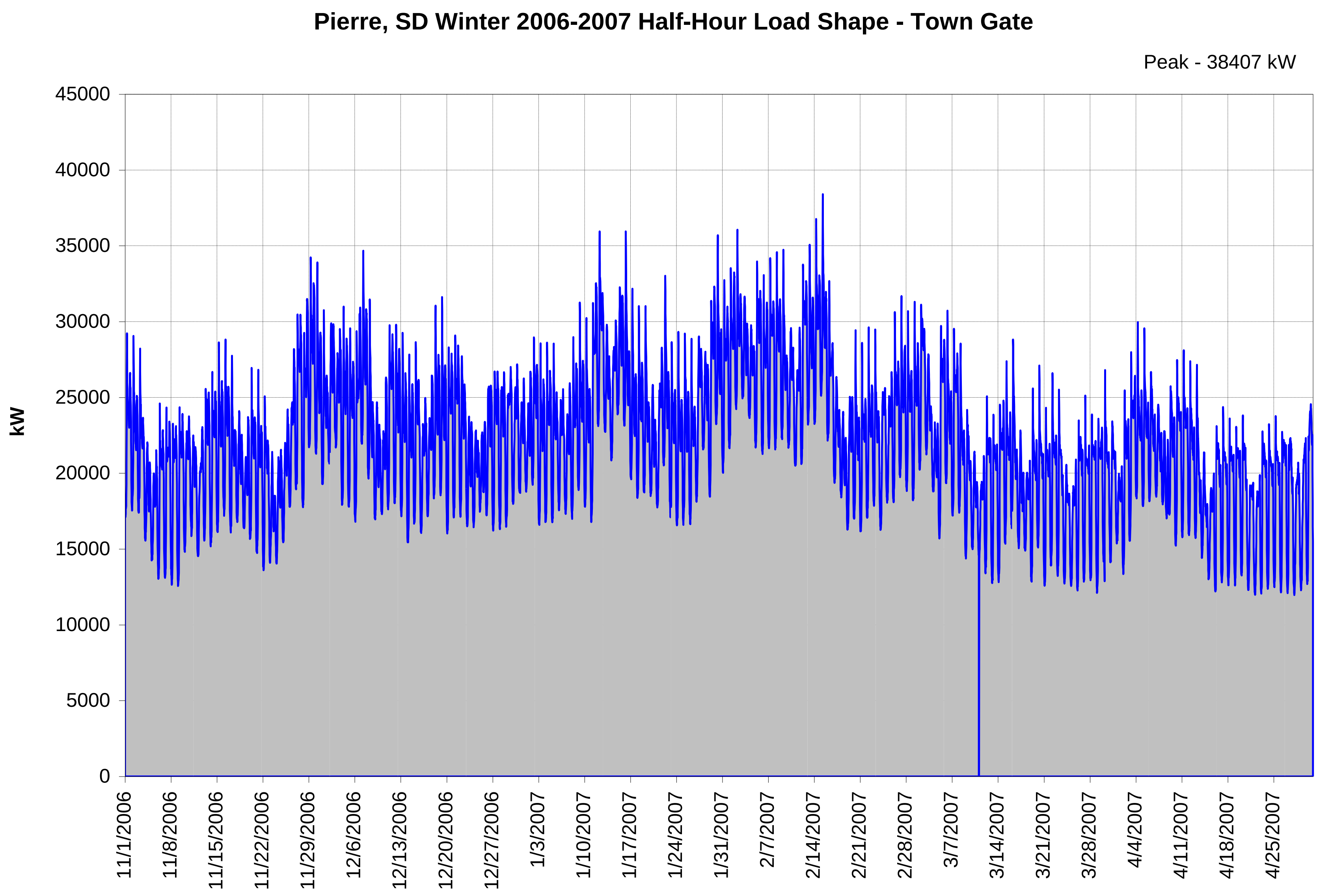

Pierre, SD
Summer Energy - Town Gate
MRES GWh
WAPA GWh
GWh
120
100
80
60
40
20
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Season

Exhibit 5



Pierre, SD Winter 2006-2007 Half-Hour Load Shape - Town Gate
Peak - 38407 kW
kW
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
11/1/2006
11/8/2006
11/15/2006
11/22/2006
11/29/2006
12/6/2006
12/13/2006
12/20/2006
12/27/2006
1/3/2007
1/10/2007
1/17/2007
1/24/2007
1/31/2007
2/7/2007
2/14/2007
2/21/2007
2/28/2007
3/7/2007
3/14/2007
3/21/2007
3/28/2007
4/4/2007
4/11/2007
4/18/2007
4/25/2007

Exhibit 6

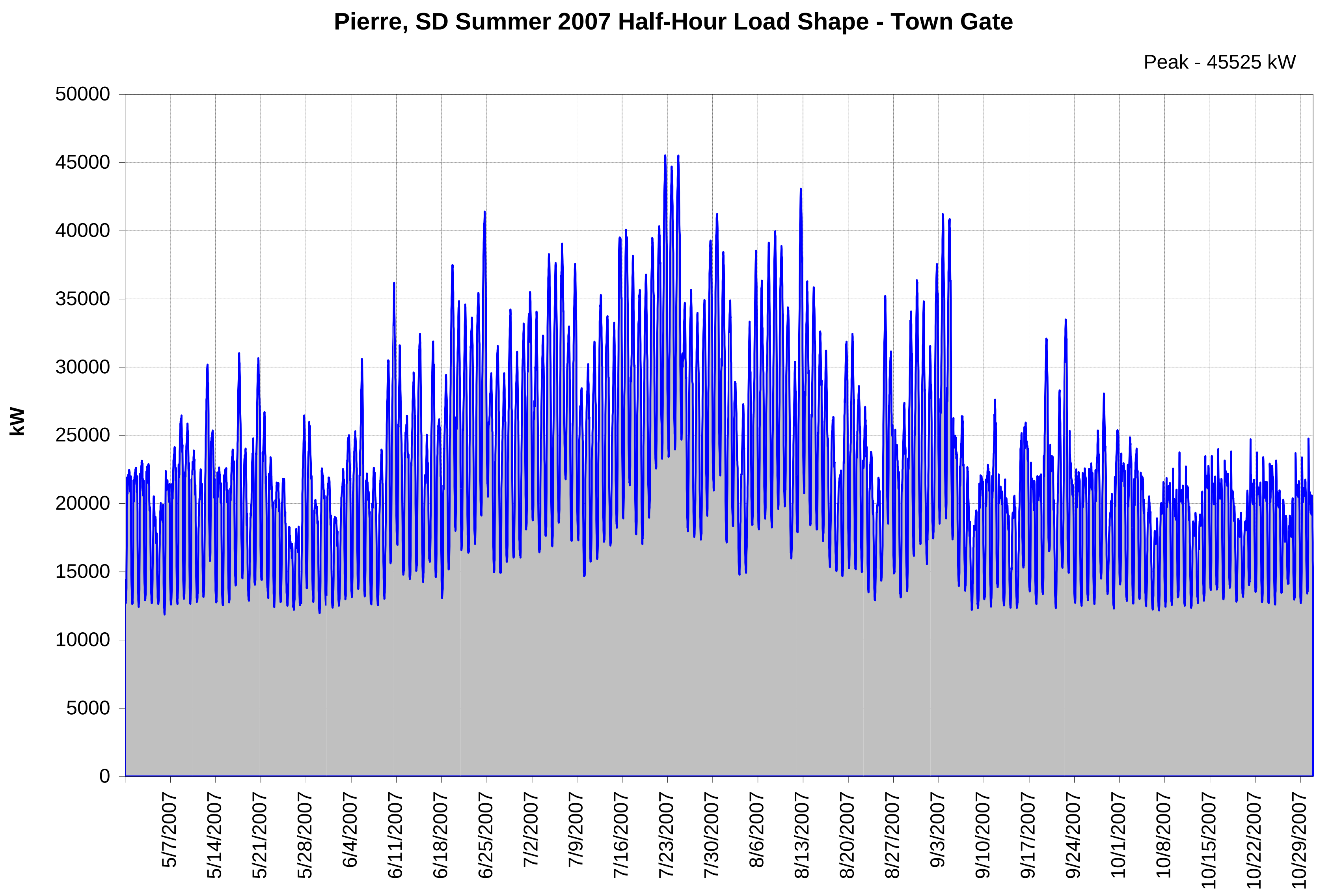
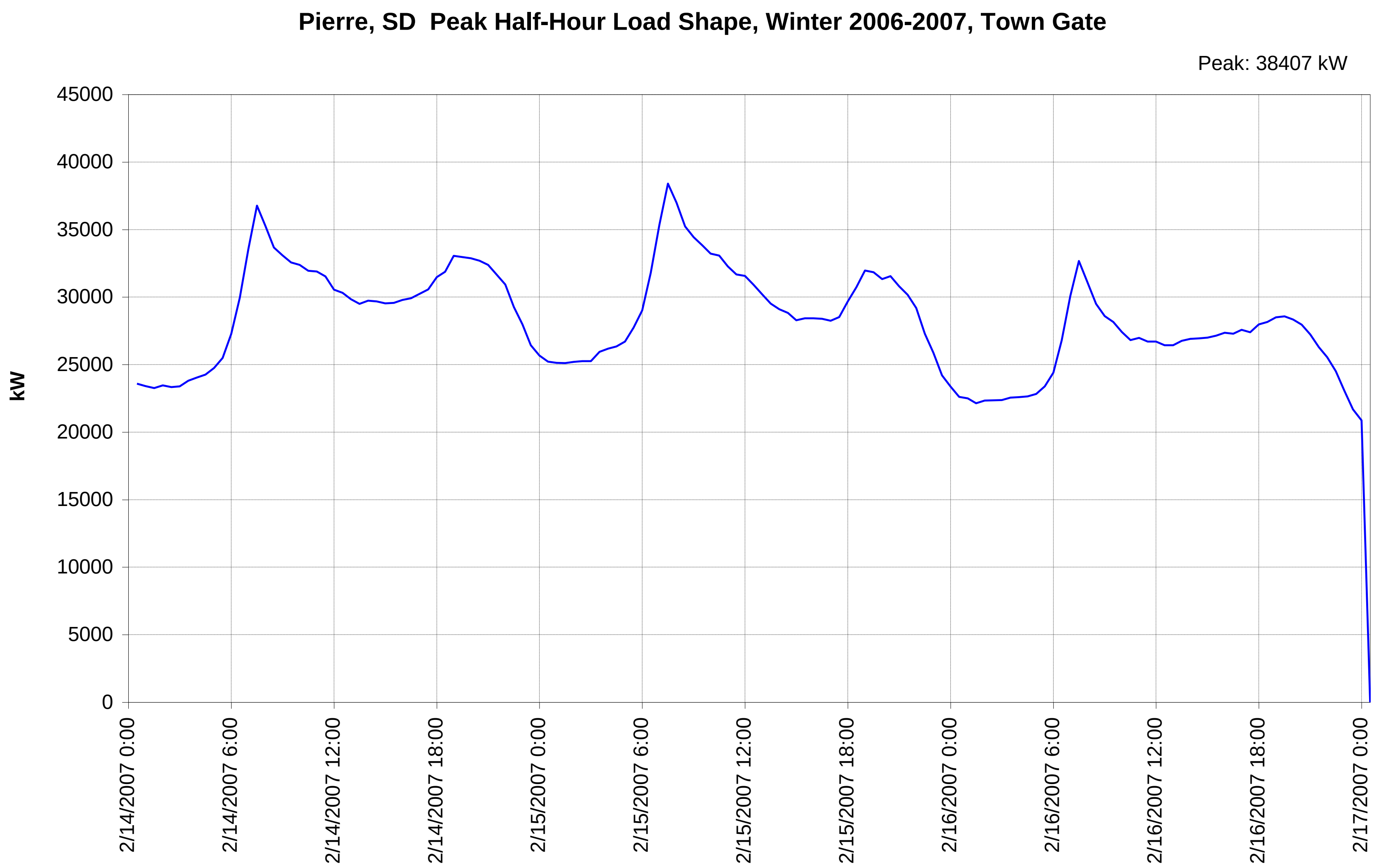
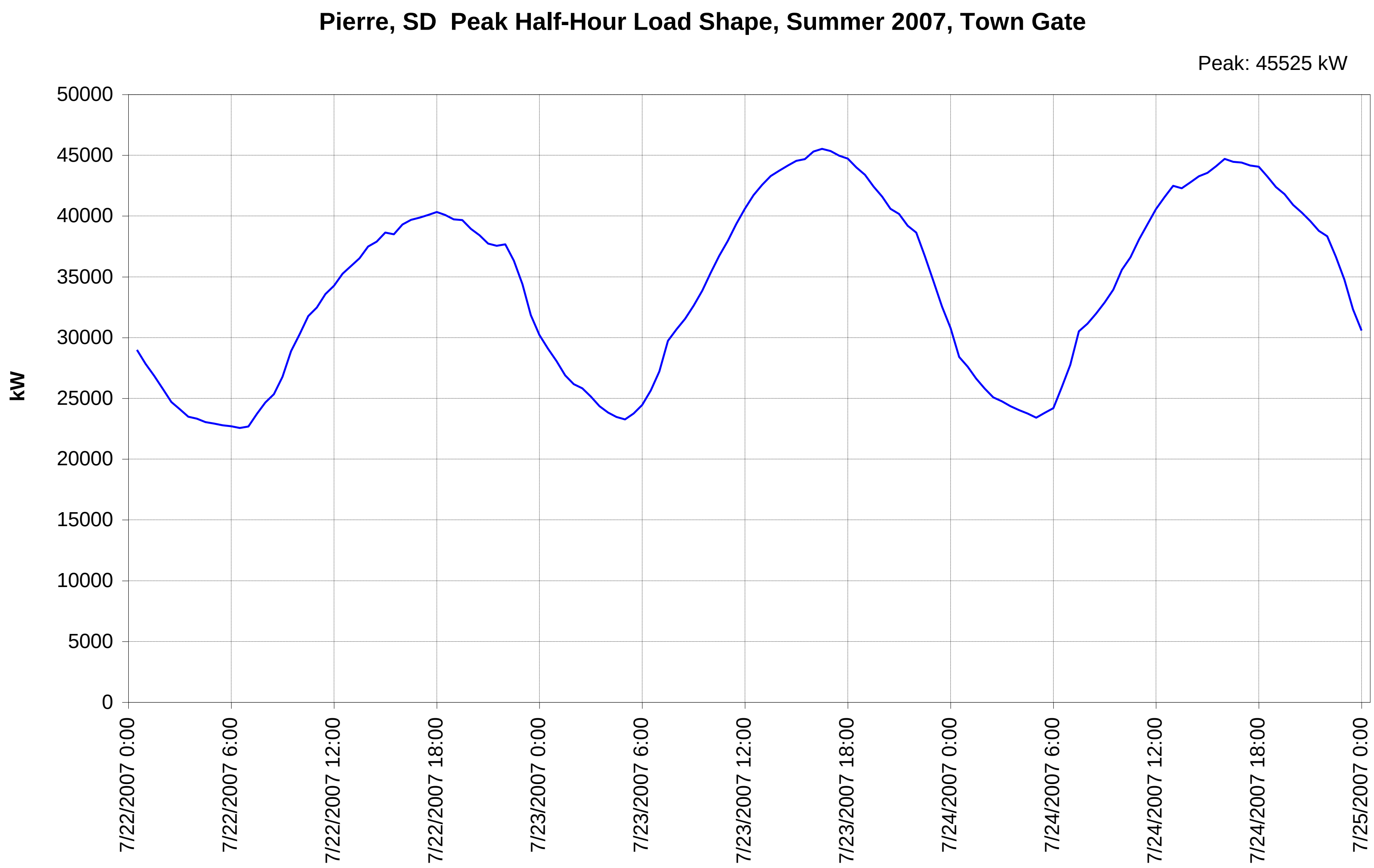

Pierre, SD Summer 2007 Half-Hour Load Shape - Town Gate
Peak - 45525 kW
kW
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
5/7/2007
5/14/2007
5/21/2007
5/28/2007
6/4/2007
6/11/2007
6/18/2007
6/25/2007
7/2/2007
7/9/2007
7/16/2007
7/23/2007
7/30/2007
8/6/2007
8/13/2007
8/20/2007
8/27/2007
9/3/2007
9/10/2007
9/17/2007
9/24/2007
10/1/2007
10/8/2007
10/15/2007
10/22/2007
10/29/2007

Exhibit 7



Pierre, SD Peak Half-Hour Load Shape, Winter 2006-2007, Town Gate
Peak: 38407 kW
kW
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2/14/2007 0:00
2/14/2007 6:00
2/14/2007 12:00
2/14/2007 18:00
2/15/2007 0:00
2/15/2007 6:00
2/15/2007 12:00
2/15/2007 18:00
2/16/2007 0:00
2/16/2007 6:00
2/16/2007 12:00
2/16/2007 18:00
2/17/2007 0:00

Exhibit 8



Pierre, SD Peak Half-Hour Load Shape, Summer 2007, Town Gate
Peak: 45525 kW
kW
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
7/22/2007 0:00
7/22/2007 6:00
7/22/2007 12:00
7/22/2007 18:00
7/23/2007 0:00
7/23/2007 6:00
7/23/2007 12:00
7/23/2007 18:00
7/24/2007 0:00
7/24/2007 6:00
7/24/2007 12:00
7/24/2007 18:00
7/25/2007 0:00

B. *Supply-side Efforts*

As explained in the section detailing MRES Resource Planning activities, MRES conducts all supply-side resource planning for its members. MRES studied traditional, as well as renewable, energy sources in its resource plan.

All supplemental power for Pierre is supplied through its joint S-1 agreement with other MRES members. All MRES resources are used to supply all of its S-1 members as a group. Therefore, it is neither possible nor necessary for Pierre to individually study supply-side resources as part of this IRP.

C. *Historic DSM Efforts*

The current DSM program plan in Pierre has been developed after considering the major markets, the saturation of electric and gas appliances, and the characteristics of the city's customers. The information was analyzed to determine both the technical and cost-saving potential of energy management improvements, any barriers that might be encountered to implementing the improvements, the realistic expectation for program participation, and any net savings that would result from the programs. Members of the community have input into the utility program selection and program participation.

As a result of performing technical and economic analysis in conjunction with community involvement, in the past the following programs have been instituted in the community of Pierre:

- Information Dissemination Program
- Interruptible Rates
- Lighting Re-design and Management
- Load Management
- Heat Pump in City Facility
- Electrical System Upgrade
- Tree Planting Program

Significant savings have resulted from instituting such programs in the City of Pierre. Listed below are some of the details from the individual programs:

- **Information Dissemination Program**

  Description: The City of Pierre has made material on conservation practices, methods, and programs available.

  Energy Savings: N/A

- **Interruptible Rates**

  Description: The City of Pierre has established interruptible rates for consumers whose operations allowed interruption of service during peak demand periods.

  Energy Savings: N/A

- **Information Dissemination Program**

  Description: The City of Pierre is designing all new lighting and replacement lighting using high-pressure sodium fixtures. Eventually, all existing fixtures will be converted to high-pressure sodium.

  Energy Savings: 460 kWh per light annually

- **Load Management**

  Description: The City of Pierre operated a load management system that controlled hot water heaters during peak periods. The City also controlled City heating and water well loads that lowered peak demand. The potential reduction on controlling hot water heaters was estimated at 3,000 kW. The potential kW reduction on City load was estimated at 1,000 kW.

  Energy Savings: Potential of 4,000 kW

- **Heat Pump in City Hall**

  Description: The City of Pierre has installed a geothermal heating and cooling unit in City Hall. The water source is the City's water supply, which is sent through heat exchangers and then returned to the City water mains for consumption by the residents of the City. The heating system was converted from oil heat and the reduction in cost of heating City Hall has resulted in a $2,000 per year savings to the City. Previously, a geothermal heating and cooling unit was in place at the Discovery Center. The project was designed to be a demonstration as it was the first system in South Dakota to use the City water supply. The system was shown to many interested parties, and initiated the installation of the heat pump in City Hall mentioned above. The heat pump in the Discovery Center has since been removed.

  Energy Savings: 25 kW per month, 109,500 kWh annually

- **Electrical System Upgrade**

  Description: The City of Pierre has been installing an underground system and making several other improvements to the distribution system. The system power factor has increased from 95 to 98.5 through prior improvements. The goal for the foreseeable future is to maintain the power factor at 98.5 while making continued improvements.

  Energy Savings: N/A

D. *Evaluation of Alternatives*

As explained in the section detailing MRES Resource Planning activities, the list of DSM activities considered was based on a comprehensive list of measures given in the Minnesota Deemed Savings Database. These measures were run individually through DSMore software with Pierre retail rates instead of MRES rates to its members, and revised participation levels that correspond to Pierre's percentage of the total MRES load. It was assumed that MRES will pay the incentives to the retail customers as a part of Bright Energy Solutions. However, these incentive amounts were left in the DSMore model to ensure that the California tests are calculated correctly, even though Pierre will not be paying any incentives directly.

E. *Options Chosen – Development of Action Plan*

DSMore software was run on each individual measure, and then grouped into programs that MRES is either currently offering (Phase I) or is planning to offer within the next five years (Phase II) as a part of Bright Energy Solutions.

i. Future Actions

Representatives from Pierre and MRES staff reviewed the summarized results for both Phase I and Phase II programs. It was assumed that Pierre would participate in both phases of Bright Energy Solutions. All of the programs soundly passed the California tests, and Pierre would have virtually no out-of-pocket costs, as MRES will be paying the incentives for all of these programs. However, for a few of the programs, anticipated participation levels (that were based on Pierre's percentage of the MRES total load) were adjusted to reflect the market potential in Pierre (as determined by utility personnel in Pierre). This step was taken only to obtain more realistic expectations for the five-year plan, and is certainly not considered to be a cap on participation in the event that the program attracts more participants than anticipated. Exhibit 9 displays the test results and assumed participation levels for Phase I programs and Exhibit 10 displays the test results and assumed participation levels for Phase II programs.

The tables in Exhibits 9 and 10 represent Pierre's five-year action plan, with the total number of participants expected by the end of the five-year period, as well as the expected kWh and kW savings expected. Note that not all of the Phase II programs are currently developed, and that the anticipated start dates of these programs are not guaranteed. Pierre expects to pursue these programs soon after MRES makes them available, but not necessarily on the exact start date.

Representatives from Pierre plan to utilize the MRES marketing materials for all the programs made available in the Bright Energy Solutions program, and take advantage of MRES assistance when possible, noting that MRES staff will primarily be assisting Minnesota members, especially in the early stages of the roll-out of Phase II programs.

At this time, future DLC program details are still in a state of flux. Therefore Pierre's future participation is only a rough estimate, with eventual participation largely dependent on how MRES structures the DLC program, and when the program begins. The participation levels indicated in the document are rough estimates only, and are only intended to show that the city is considering implementing the DLC program at some future date.

ii. Milestones

As part of the annual WAPA IRP updates, Pierre will evaluate the progress on these programs. The success will be measured against this five-year plan, with adjustments made for actual customer participation, and any changes to the roll-out schedule of Phase II programs.

Measurement and validation of the Bright Energy Solutions programs will be ongoing. Quality control, measurement of savings, verification tracking, and program evaluation are important components of a successful DSM program and they are critical to MRES if DSM is to be relied upon as a power resource. One percent (1%) of the 2009 MRES DSM budget, and five percent (5%) of the 2010 and beyond budgets, has been set aside for evaluation, monitoring, and verification efforts. For verification, all incentive applications will have a paper and calculation review. Field inspections will be completed on a minimum of five percent (5%) of all installations and ten percent (10%) of installations over $5,000 in total incentives. Field inspections will be conducted on one hundred percent (100%) of installations over $10,000 in total incentives and on one hundred percent (100%) of custom projects.

For custom projects, MRES will require detailed estimates of kW and kWh savings that will be achieved as a result of the project, along with the sources and references for all values used. This may include certification of savings calculations by a qualified engineer. For projects with estimated savings larger than 1,000,000 kWh per year, or for projects involving new technology, MRES may require that energy savings be verified through metering or energy testing of kW and kWh before and after installation of the proposed equipment.

Detailed program evaluation plans will be developed in 2009 through a third party evaluation consultant. They will include both impact and process evaluation efforts. The results of any such future validation program will be made available upon request.

Exhibit 9

Pierre, SD

DSMore Phase I Results

Pierre, SD Proportion

Program	Participants by Year 5	Annual Incentive Costs by Year 5	kWh Cumulative by Year 5	Annual kW by Year 5
Energy Efficient Lighting	1,581	$ 54,667.27	3,193,472	743
Energy Efficient Air Conditioning - (Cooling/Chiller Program)	7	$ 4,263.37	178,336	72
Energy Efficient Motors/Pumps/Drives	3	$ 1,143.76	204,124	67
Custom	3	$ 17,609.33	644,233	220
Total - All Programs	**1,594**	**$ 77,683.74**	**4,220,164**	**1,103**

Test Results

Program	Cost of Conserved Energy (kWh)	Cost per kW	Utility Cost Test (UCT)	Total Resource Cost (TRC) Test	Rate Payer Impact Measure (RIM) Test	Societal Test
Energy Efficient Lighting	$ 0.014	$ 121.33	7.4	4.4	1.2	4.9
Energy Efficient Air Conditioning - (Cooling/Chiller Program)	$ 0.011	$ 97.49	11.5	7.5	1.3	8.3
Energy Efficient Motors/Pumps/Drives	$ 0.004	$ 28.20	26.3	7.7	1.3	8.6
Custom	$ 0.017	$ 159.97	6.1	0.2	1.2	0.2

** Values greater than 1 for UCT, TRC, and RIM tests indicate passing result.*

Exhibit 10

Pierre, SD

DSMore Phase II Results

Pierre, SD Proportion

Program	Tentative Start Date	Participants by Year 5	Annual Incentive Costs by Year 5	kWh Cumulative by Year 5	Annual kW by Year 5
Prescriptive	January 2009	31	$ 2,000.66	85,894	27
Custom	January 2009	3	$ 17,609.33	644,233	220
Residential HVAC	October 2009	69	$ 11,334.08	58,454	50
Energy Star New Construction	October 2009	2	$ 788.26	10,651	2
Residential Energy Star Products	January 2009	142	$ 5,278.54	44,468	16
Residential Lighting	January 2009	1,689	$ 2,533.70	336,514	307
Direct Load Control	-	1,556	$ 9,239.18	-	2,123
Total - All Programs	**-**	**3,580**	**$ 51,725.66**	**1,323,432**	**2,787**

Test Results

Program	Cost of Conserved Energy	Cost per kW	Utility Cost Test (UCT)	Total Resource Cost (TRC) Test	Rate Payer Impact Measure (RIM) Test	Societal Test
Prescriptive	$ 0.013	$ 123.69	18.0	6.0	1.2	6.7
Custom	$ 0.017	$ 159.97	6.1	0.2	1.2	0.2
Residential HVAC	$ 0.071	$ 373.70	2.0	0.9	0.8	1.0
Energy Star New Construction	$ 0.043	$ 528.85	2.7	2.2	0.9	2.4
Residential Energy Star Products	$ 0.051	$ 555.59	3.6	3.3	1.1	3.6
Residential Lighting	$ 0.007	$ 13.61	14.3	8.9	1.2	10.1
Direct Load Control	-	$ 35.37	44.0	7.1	1.4	7.4

** Values greater than 1 for UCT, TRC, and RIM tests indicate passing result.*

F. Environmental Effects

The environmental benefits of the DSM programs were not calculated specifically. However, any program that decreases energy consumption will, by definition, decrease the amount of energy generated. Given that a majority of generation is from non-renewable sources, DSM programs will serve to decrease emissions. Additionally, DSM programs that reduce electric demand will mean fewer new generation facilities will need to be constructed in the future.

G. Public Participation

A preliminary draft of this report was produced on December 9, 2008. This draft was reviewed by Bradley E. Palmer, Utilities Director. A revised draft was completed on August 10, 2009. A notice of public hearing on IRP was published in the local newspaper on [Date]. The public hearing on the IRP was held at the August 25, 2009 City Commission meeting. A summary of any comments and responses made during the meeting are included in the Appendix. The City Commission approved the resolution on August 25, 2009. A copy of the approved resolution is included in the Appendix.

IRP Approval Process	
Preliminary Draft Date	***12/9/2008***
Preliminary Draft Reviewed By Bradley E. Palmer – Utilities Director	***08/05/2009***
Draft Revision Completion Date	***08/10/2009***
Date Published in Paper	
Public Hearing Date	***08/25/2009***
Date Approved by City Council	***08/25/2009***

Appendix A